REMARKS

Applicants and their undersigned attorney have carefully reviewed the second, non-final Office Action of November 24, 2004 in the above-identified patent application, together with the prior art references cited and relied on by the Examiner in the rejections of the claims. We continue our assertion that the cited references disclose photonic package devices and techniques that are unsuitable and undesirable for achieving highly accurate optical fiber alignment as is required for modern high speed (40 Gbps and beyond) photonics packaging. The present invention is not anticipated by, and is not obvious in light of, the prior art. In response, the claims of the application have been amended again to more clearly define the subject invention over the prior art cited and relied on by the Examiner. Reexamination and reconsideration of the application, and allowance of the claims is respectfully requested.

The subject application discloses and claims a hermetically sealed photonics package as well as a process for aligning an optical fiber with a photodetector in a housing during fabrication of a such photonics package. The present invention, as now defined in method and apparatus claims, is highly distinctive in that it provides advantages that have not previously been achieved. First, the present invention provides a package wherein the automated placement of the photonic components (e.g. photonics device, IC, substrates, resistors, capacitors, etc.) is completed entirely within the same plane, which is crucial for achieving high-speed optoelectronics modules. The connection from the photodetector chip to the next component take place in a single plane. Bent connections are not required. This allows for smaller packages and higher speed data transfer. Further, the process utilizes laser welding as the primary means of aligning and fixing a fiber to a device with sub-micron accuracy. A settable solder is used mainly as the means of hermetically sealing the flange to the housing. The present invention also provides a practically designed package that has the optical axis and RF connector axis on the same plane to facilitate assembly

at the next level. Although one skilled in the art will appreciate additional advantages, the attached amendments and remarks stress the features above.

The package includes a hermetically sealed housing having a rear wall 14, a front wall 16, a top wall 18, a bottom wall 24 and two sidewalls 20, 22. The front wall 16 has an aperture 28. The photodetector 42 may be inserted through the front wall 16 and is mounted on the rear wall 14 at a location opposite the aperture. A first closure 26 covers the aperture 28, and the first closure 26 incorporates a window 30 generally aligned with the photodetector. The top wall 18 also includes a viewing aperture 34.

A jacketed optical fiber 68, which supplies optical signals to the photodetector 42, is inserted into a ferrule 64 with an end of the fiber 68 extending beyond the ferrule 64. The ferrule 64 and fiber 68 are sealed together. The ferrule 64 is then inserted into a coaxial flange 80 so that the ends of the ferrule 64 and the optical fiber 68 extend through the flange 80 and the window 30 located in the first closure 26. Using the viewing aperture 34, the optical fiber 68 is aligned with the photodetector 42 by laterally adjusting the flange 80 and longitudinally adjusting the ferrule 64 within the flange 80. The ferrule 64 is then welded to the flange 80. The flange 80 is initially welded to the exterior surface of the first closure 26 around the window 30 by laser welding and, more specifically, by laser spot welding. Any misalignment can be corrected for by adding additional spot welds. A settable solder-preform, already in place within an annular groove on the cover, can then be reflowed to hermetically seal the flange to the package. Since the flange is already secured in place by welds, movement due to the setting solder is minimized. However, the package can be realigned as the solder sets by an automatic mechanism and more spot welds to attain the necessary sub-micron accuracy. The viewing aperture 34 is sealed by a second closure 36. Laser welding is used during the process to join the various parts as well as hermetically seal the package.

The specification has been amended to clarify the subject invention and correct various errors. Paragraph 0009 has been amended to state that the flange is secured *over* the fiber alignment window (see Fig. 4 and Paragraph 0020). The paragraph now more clearly conveys the idea that the flange is secured to the first closure via a laser weld (see Paragraph 0020) while the slow-setting sealant is primarily used to hermetically seal the photonics package. The amendments do not add new matter.

In the Office Action of November 24, 2003, claim 1, after amendment, was rejected under 35 U.S.C. 102 as being anticipated by Goodfellow et al. Goodfellow had been made of record by the Examiner, but the reference had not been relied on as a basis of rejection. Method claims 1, 5, 6, and 9-13 are also rejected under 35 U.S.C. 103 as being unpatentable over Falkenstein et al in view of Goodfellow et al.

Goodfellow teaches a method for fabricating a photonics package. However, as an individual skilled in the art of photonic packaging will appreciate, the Goodfellow process results in a non-complex package limited to low bandwidth and low data rate devices. Specifically, Goodfellow teaches a photodetector 6 is positioned in a housing formed by a cover 2 and base 4. An optical fiber 10 is inserted through, and secured to, a flange 16. The fiber extends into the housing. The flange 16 is held in place by melting a settable sealing material around the flange. Goodfellow does not disclose the process of the present invention, as now set out in the claims of this application; in particular, the process steps: sealing a closure over the aperture opposite of the photodetector, providing a fiber alignment window in said closure, securing and sealing a flange to the surface of the package, viewing the optical connection between the photodetector and optical fiber, or sealing a second closure over a viewing aperture are claimed but are not found in the Goodfellow reference.

The sequence of welding the flange, activating the solder, and making adjustments and

additional spot welds *while* the solder sets is conspicuously absent in Goodfellow. As the molten material or epoxy used in Goodfellow sets its volume will decrease, which would shift the fiber out of optical alignment. Goodfellow does NOT teach the important step of adjusting the position of the flange on the housing while affixing the flange. Final alignment takes place *before* the solder begins to solidify. Goodfellow specifically states at Col. 4, line 16, "[w]hen *final* optimization of alignment has occurred the heating means are removed" (emphasis added). On the other hand, the application of the present invention claims "adjusting the position of the flange on the housing and further laser welding the flange as said sealing material sets to accurately position the optical fiber with respect to the photodetector..." The application's specification explains this step at Paragraph 0022" "As the solder cools, the optical fiber assembly 32 is realigned as necessary..." Notwithstanding the fact that Goodfellow does not disclose or even suggest this process as previously claimed, in order to further the prosecution of this application, Claim 1 has been further amended in order to more clearly distinguish the present invention over the prior art. Accordingly, it is respectfully submitted that Claim 1 is not anticipated by the Goodfellow reference under 35 USC 102, and is clearly allowable.

Claim 1 and claim 13 were also rejected under 35 USC 103 as unpatentable over Falkenstein in view of Goodfellow. Falkenstein also describes technology used for low speed photonics packaging (e.g., large aperture photodiode or LED and multimode fiber). For example, one who is skilled in the area of optoelectronics packaging will recognize that placing a glass fiber into a long, stiff tube that is air-tight (Col. 5, line 65; claim 1) is not recommended in present day optoelectronics packaging as it is very difficult to do so without damaging or breaking the fiber. Falkenstein discloses a photonics package including: a housing (G, K) including spaced front and back walls; a photosensitive element mounted within the center of the housing on an intermediate carrier P/B; a wall opening W through said front wall opposite said

photosensitive element; a optical fiber L and a flange T. The flange is laterally adjustable and secured to the surface of the front wall of the housing, but, as the Examiner notes, the solder used in Falkenstein is not disclosed as being "a settable material to allow alignment of said optical fiber while said material is setting" (Nov. 24, 2003 Office Action, page 3). Falkenstein clearly teaches away from the use of welding during construction in stating that "[i]n the fourth step, performed after the third step, the adjustment member T is secured to the housing G as well as to the tube R , and/or to the one or more transition pieces U, being, for example, glued to soldered thereto in that ***welding***, in this case, would frequently provide too great of a disturbance to the achieved adjustment after the fact" (emphasis added)(Col. 9, line 64 - Col. 10, line 2). In contrast, and as clearly set out in the claims, the flange of the present invention is initially set by welding and settable solder is used primarily to hermetically seal the package, while allowing a final adjustment by further welding.

Neither Goodfellow or Falkenstein teaches aligning a flange as a sealing material sets. The references do not teach viewing the alignment between the fiber and optical component through a viewing aperture. They do not teach a closure welded over a first aperture opposite the photosensitive element. They do not teach welding the flange to the surface of that closure. They do not teach welding a second closure over the viewing aperture. Of course, Falkenstein also does not teach how to modify Goodfellow, or vice versa, to produce the claimed invention. Falkenstein (issued 1987) and Goodfellow (issued 1982) do not teach modern highspeed photonics packages (40 Gbps and beyond).

Therefore, as the references, even in combination, do not teach the claimed elements and the references to not teach or suggest that the references should be combined or modify each other, claims 1 and 13, as amended, are now believed to be allowable over the Examiner's 102 and 103 rejections. Dependent method claims 9 and 10, as amended, are now thought to be

allowable over the 103 rejection based on Falkenstein in view of Goodfellow. Claims 5, 6, 18 and 19 have been canceled.

The apparatus claims, Claims 14, 16, 20 and 21, were rejected under 35 U.S.C. 103 as being unpatentable over Falkenstein in view of Goodfellow and Boger. Boger describes a specific photonic package that employs the use of a bulkhead optical connector (see Field of the Invention). Boger discloses a photonics package including: a housing including spaced front and back walls; a photosensitive element 12 mounted within a cavity 14 of the housing; a fiber adjustment window 28 through said front wall opposite said photosensitive element; a fiber optic assembly including an optical fiber 20 surrounded by a ferrule 24 and a cylindrical flange 34 receiving said optical fiber. The Boger package is specifically side-emitting or side-collecting and can not be read onto the present invention whereas the present invention aligns a fiber perpendicularly to a surface collecting or surface-emitting photonic device. The components of the present invention are located in the same plane. Boger illustrates a 90-degree electrical connection via ribbon bond, epoxy, circuitry metallization, or the like, that diminishes the critical electrical connections from the photonic device to the output RF connector. Package performance, producibility, and repeatability are reduced. The same plane technique of the present invention is particularly crucial for high bandwidth (>10 Ghz) and high data rate (>10 Gbps) devices.

The present invention includes numerous features that distinguish it from the Boger reference. The slow-setting sealing material allows the flange, and thus the fiber, to be repositioned while the flange is sealed to the housing. Boger, either alone or in combination with the other references does not disclose the groove 90 of the present invention. The groove contains the sealing material. Once the flange is welded to the front wall, the sealing material is reflowed to hermetically seal the package. The fiber can be realigned, as necessary, while the

sealing material sets. It would not have been obvious to combine the side-emitting or side-collecting package of Boger with either Goodfellow or Falkenstein. Clearly, the references do not contain a suggestion that they should be combined. Moreover, the present invention is a much more efficient design than Boger as the 90 degree connection between the photodetector and the next component is eliminated. In any event, the combined references do not disclose the groove of the present invention. This element is contained in the amended claims.

Claim 14 has been amended to more clearly define the present invention over the prior art rejections. The claim now distinctly points out the settable sealing material for hermetically sealing the flange to the housing. The spot welded connections are set forth in the claim, as well as the additional connections that can be added *while* the sealing material sets to seal the flange to the housing. Claim 14, as well as claims 16 and 20, which depend from claim 14, are now believed to be allowable. Claim 21 has been canceled.

In conclusion, claims 1, 9, 10, 13, 14, and 20 have been amended. Claim 1 now also includes the step of determining the relative location of the optical fiber with respect to the photodetector through a viewing aperture in the housing. The claim, as amended emphasizes that a slow-setting sealant provides the flange's hermetic seal. Amended claim 13 also includes the distinction between the welding to secure the flange and the sealing accomplished by the solder. Both claim 1 and 13 now clearly provide that adjusting the position of the flange on the housing while the slow-setting sealant sets involves the step of creating additional welding connections between the flange and housing. Claim 14, as amended, includes a limitation directed to groove 90. Claims 5, 6, 12, 18, 19 and 21 have now been canceled. Claim 16 was previously presented. No claims have been added. It is believed that the claims now pending are patentable over the prior art cited and relied upon in the Office Action. In view of the foregoing, reconsideration and re-examination of the application, allowance of the claims, and the passage of the application to

issue is respectfully requested.

Respectfully submitted,

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